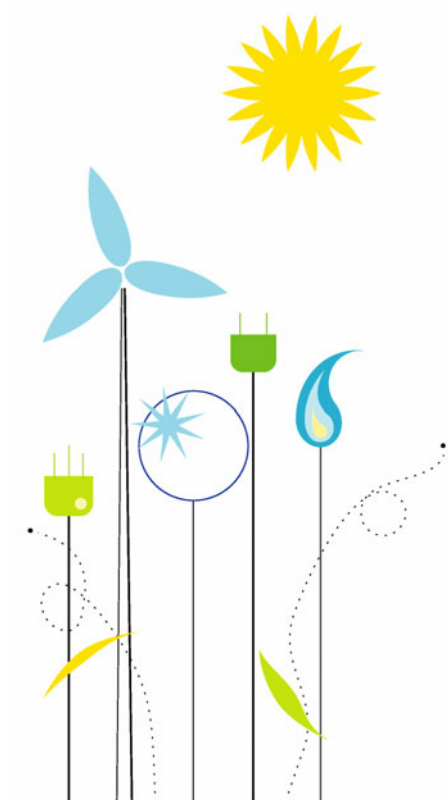


# Industrial-Scale CCS Projects: US and International

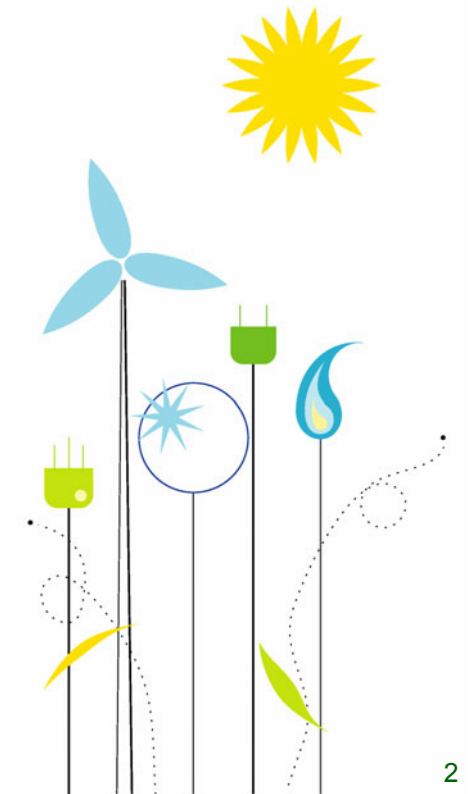
Iain Wright, CO<sub>2</sub> Project Manager, BP  
NETL CCS Conference: Pittsburgh May 8<sup>th</sup> 2007



# Agenda



- **What does a CCS Project Developer need?**
- **Progress in:**
  - USA
  - Europe
  - Australia
  - China
  - Middle East
- **Summary**



# BP CCS Technology Program



## Research



## Industry / Academic Initiatives



CO<sub>2</sub> Capture Project

### Source-sink matching

CO<sub>2</sub>CRC, EUGeocapacity, Coach, US Regional partnerships

### Public policy support

CSLF, ECCP, EU-ZEPP, CDM

### Assurance framework

CO<sub>2</sub>CRC, CSLF, IMCO<sub>2</sub>, WRI

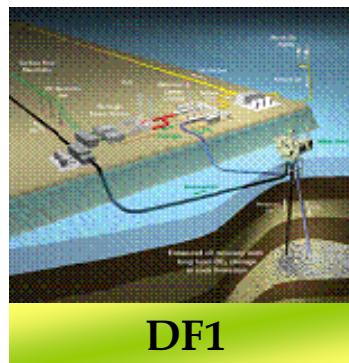
### 3rd Party Demonstrations

Sleipner, Weyburn, CO<sub>2</sub>Remove

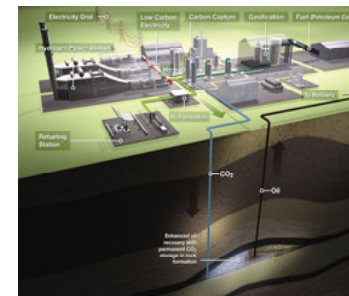
## Technical Demonstrations



## Industrial Scale Projects



DF1



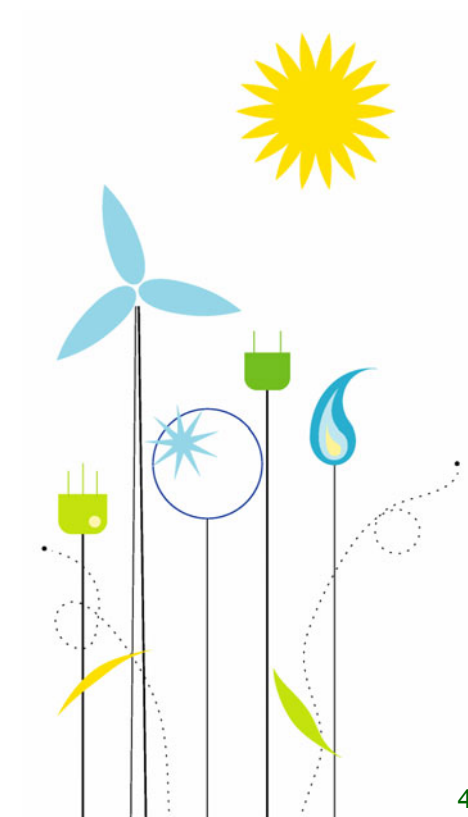
DF2

TBA

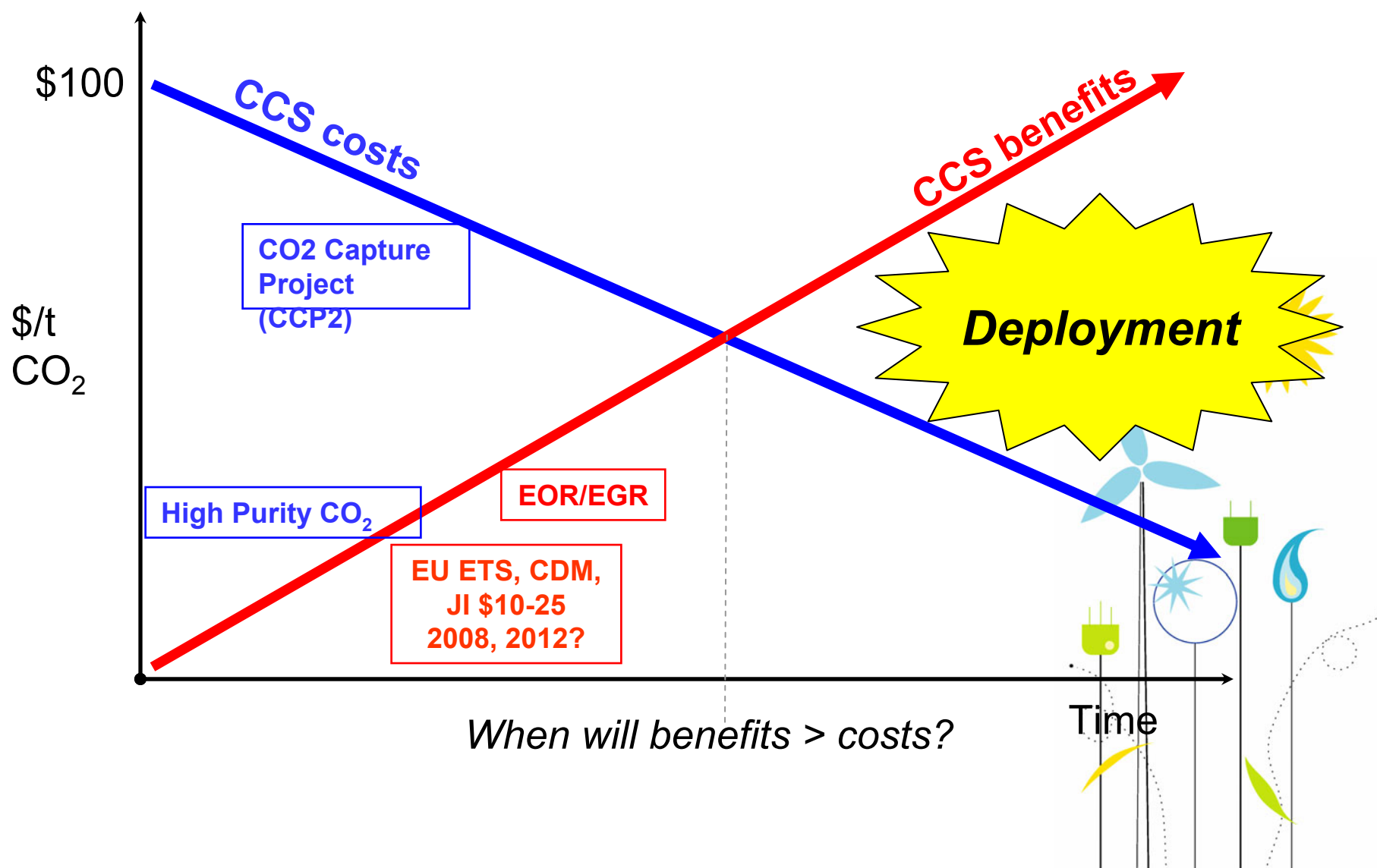
DF3, 4, 5 ...



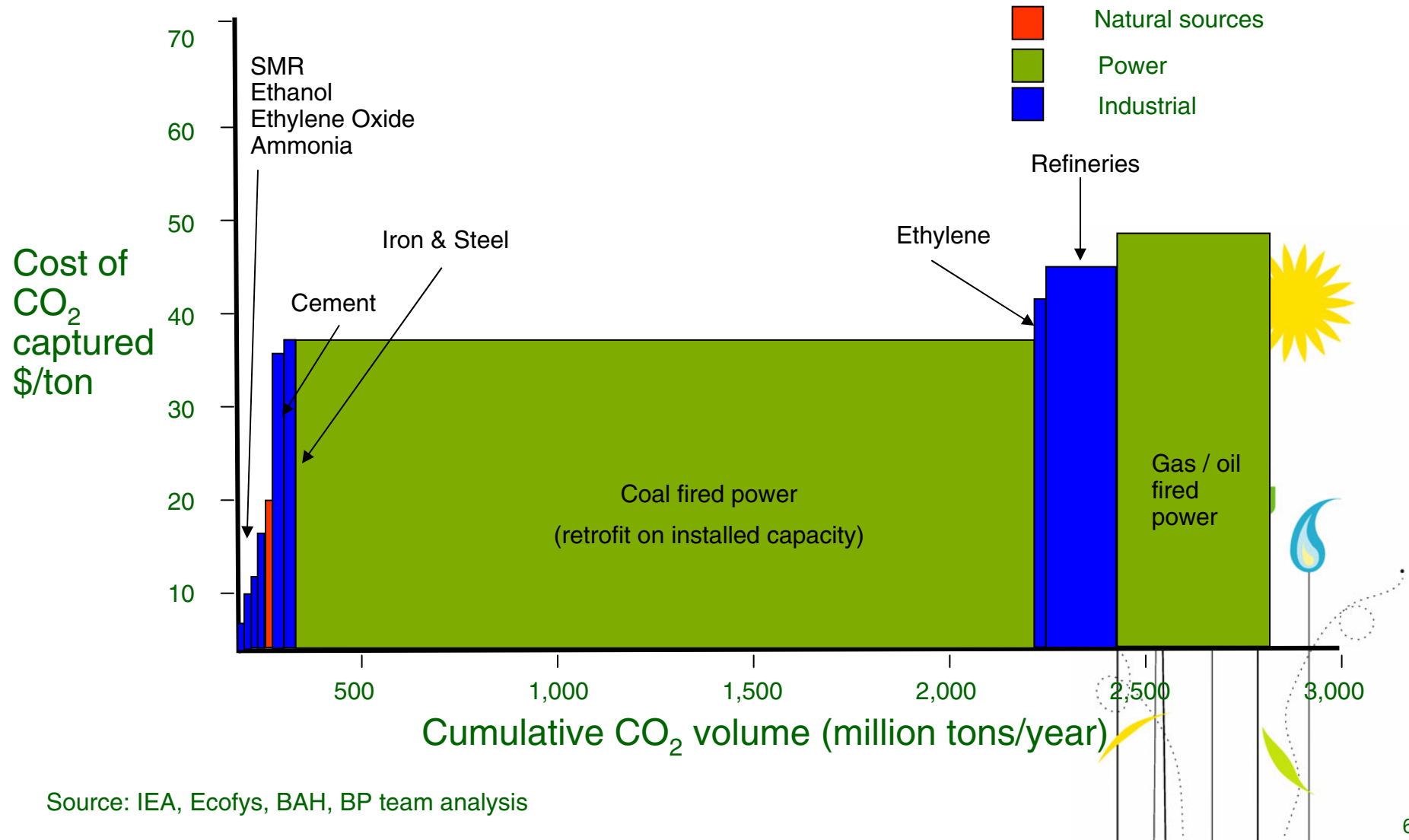
# What does a CCS Project Developer need?



# When Will CCS be Deployed?

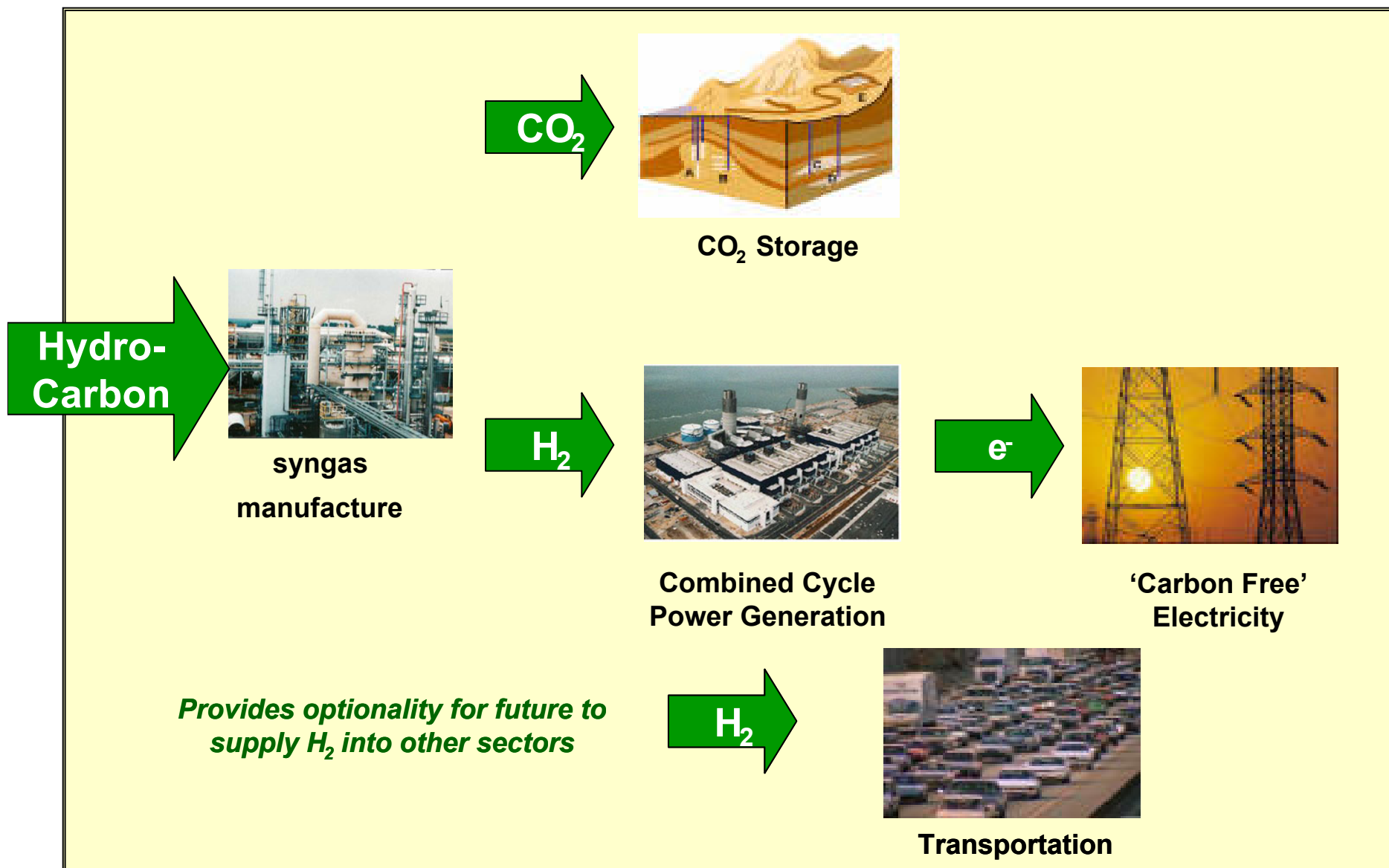


# US CCS Opportunities



Source: IEA, Ecofys, BAH, BP team analysis

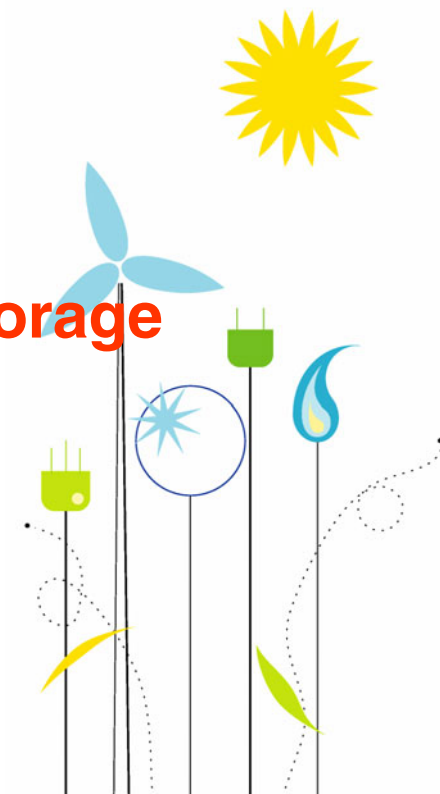
# A Business Model for CCS Deployment





# CCS Project Developer Requirements

- Growing Power Market
- Advantaged fuel, infrastructure, geology
- Supporting Government Policy
- Regulatory Framework for Geological Storage

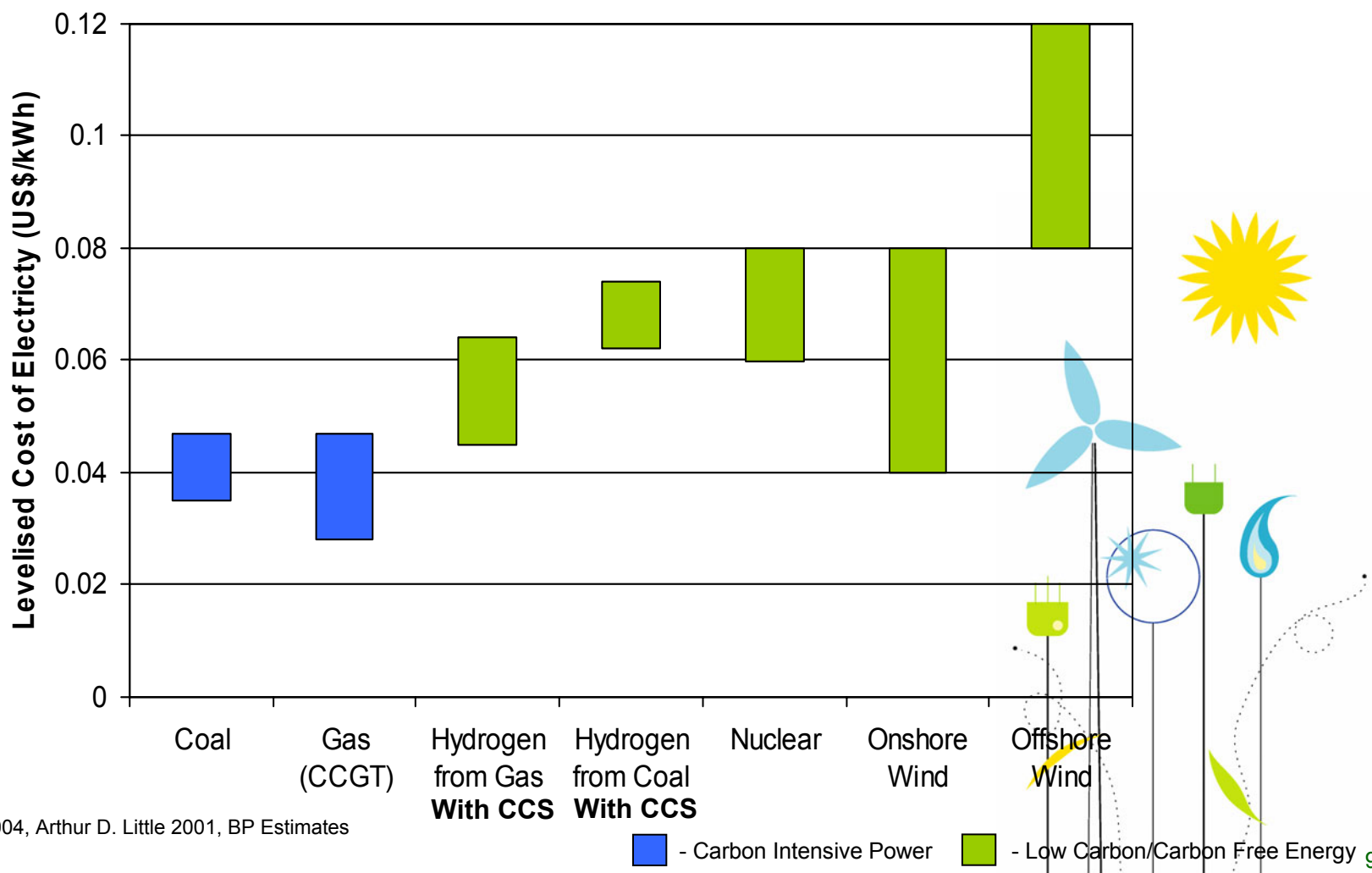






# Policy Framework

**CCS allows fossil fuels to deliver a similar product to other technologies**  
**Project incentives could be similar**

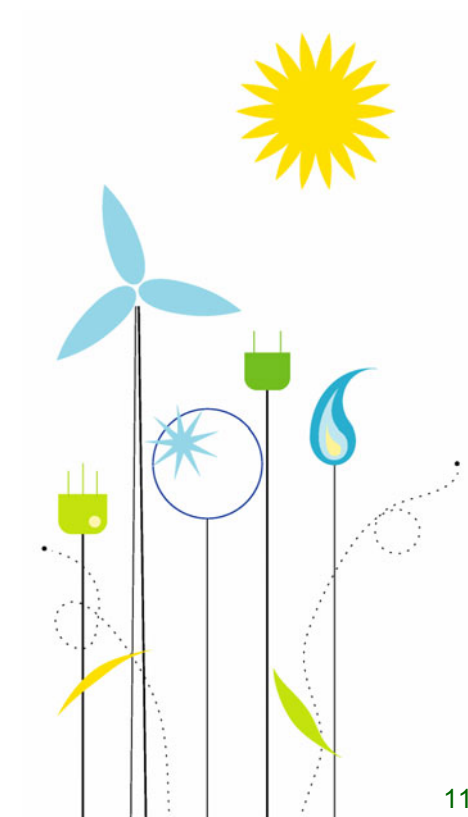






## CCS Initiatives: Around the World in 10 Minutes

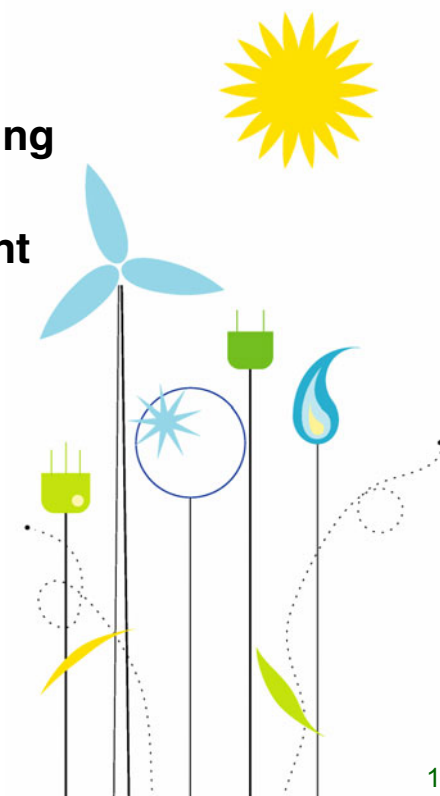
- **USA**
- **Europe**
- **Australia**
- **China**
- **Middle East**





## USA Initiatives: Federal

- **Ongoing DoE R&D Funding:**
  - **Regional Partnerships (Phases 1, 2, 3)**
- **Congress:**
  - **Numerous Hearings and Bills:**
    - **Bingaman: Funding for CCS Pilot Projects**
    - **Salazar: Mapping Storage Locations (not re-inventing the wheel)**
- **EPA and DoE to jointly evaluate how the storage of CO<sub>2</sub> might affect groundwater supplies**



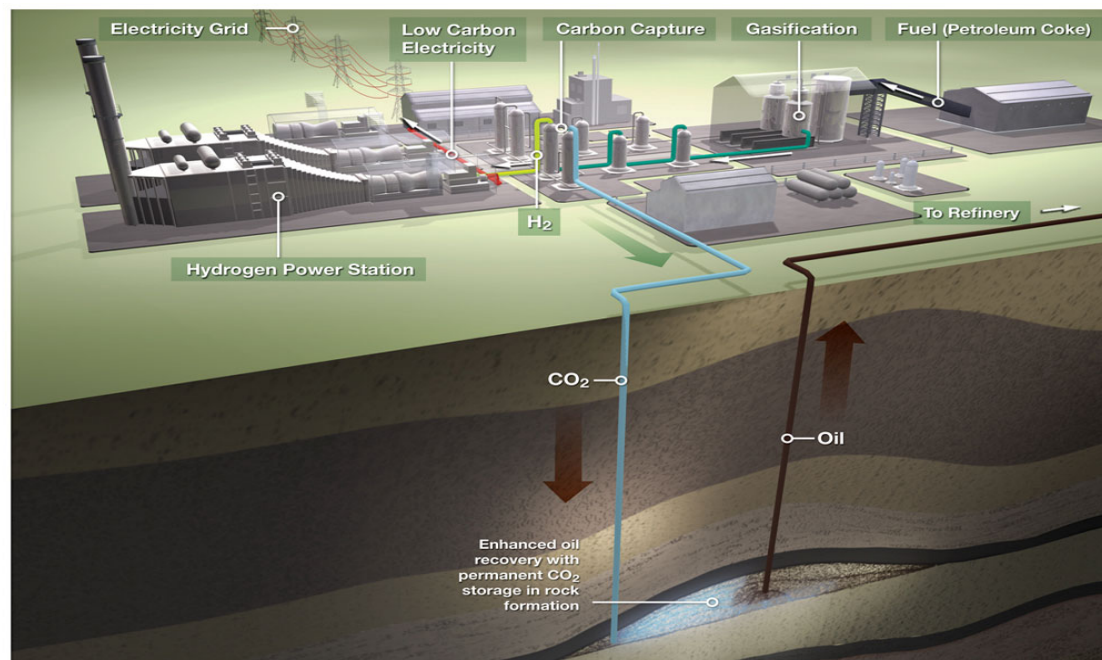


## USA Initiatives: State

- **Texas**
  - Early Policy Framework enabled Texas to become the leading provider of wind power
  - 2007 so far: 15 State initiatives to support low-carbon power
  - Huge appetite for CO<sub>2</sub> EOR (Tax Breaks)
  - Pursuit of FutureGen has driven new legislation
- **California**
  - Leadership in Climate Change Policy via AB32, SB1368, CA PUC GHG Emission Performance Standard, and AB 1925
  - AB1925 (law) Requires CEC to provide policy recommendations to the CA legislature by Nov 2007 “to accelerate the adoption of cost-effective geological sequestration strategies for the long-term management of industrial CO<sub>2</sub>”
  - Pending bills:
    - AB705: establish jurisdiction for CCS regulatory framework
    - AB114: incentivize carbon capture technologies



# Carson Hydrogen Power Project, California



## Project Milestones

- World's largest hydrogen-fired power generation facility
- Would use gasification technology to gasify petcoke – a solid fuel generated as a byproduct of the refining process

## Climate Change Milestones

- 500 MW of clean electricity ~ 325,000 Southern Californian homes
- 4 mmtpa CO<sub>2</sub> avoided
- Pipeline infrastructure to transport the CO<sub>2</sub> for EOR and permanent storage
- Lowest CO<sub>2</sub> emissions in the world for an IGCC plant.



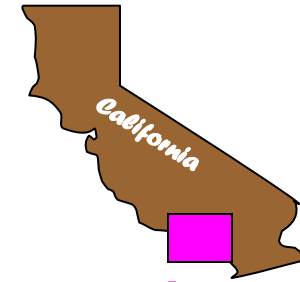
## CHPP – an advantaged location

- Industrial zoning
- Coke disposition
- Existing H<sub>2</sub> infrastructure
- Local CO<sub>2</sub> sequestration options
- Major (Electrical) Load Center

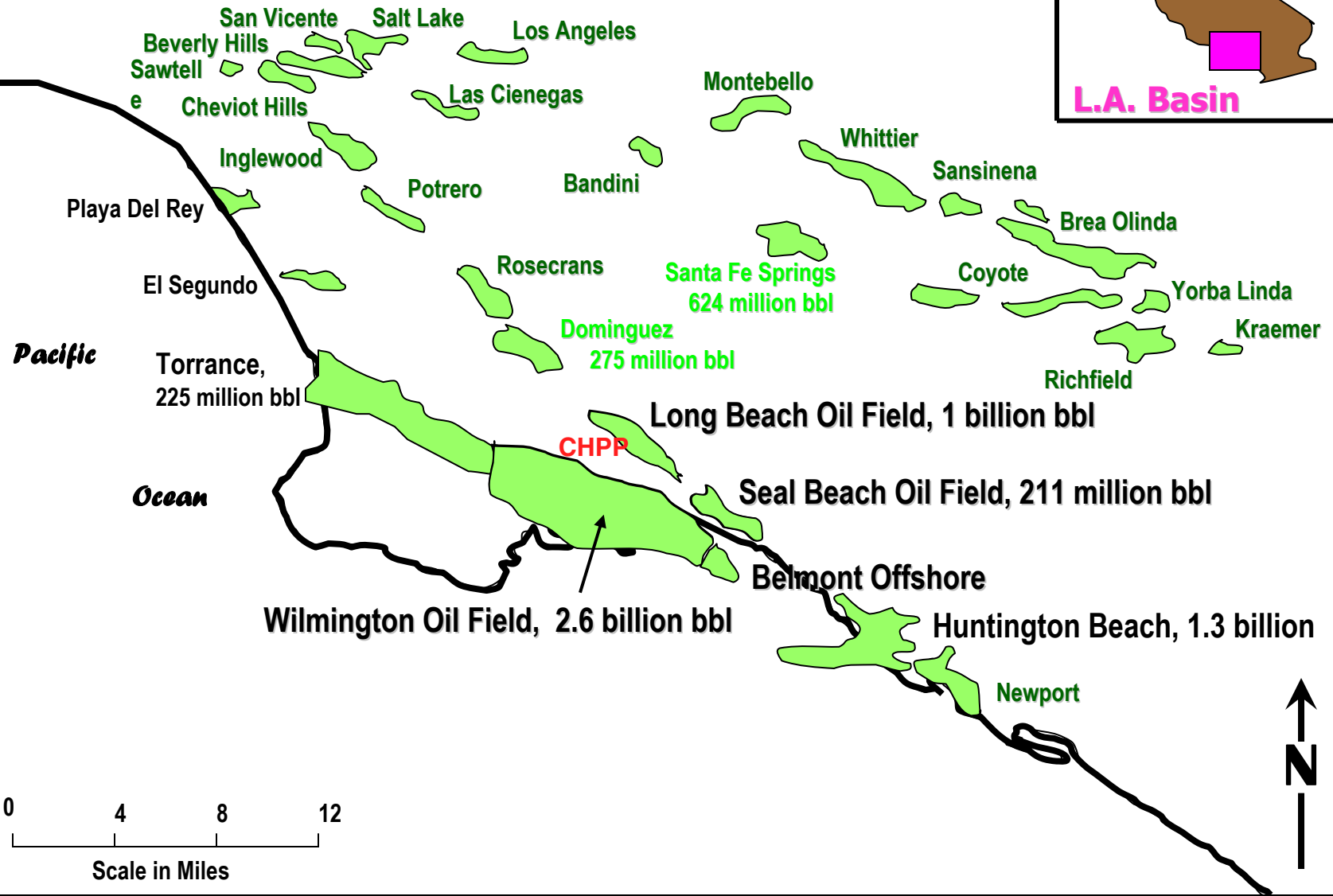




# The LA Basin: A Storage-Rich Environment



**L.A. Basin**







# CHPP: Enabling Policies

- **Permits for Power Plant, Pipeline, Sequestration**
- **Long-Term Low-Carbon Power Procurement Contract**
- **Reasonable Policy Framework for CCS Siting, Monitoring, Measuring & Verification and Long-Term Liability**
- **Emission Reduction Credits from SCAQMD via Rigorous Offset Strategy**
- **E-NGO Support and Engagement at local, state and federal levels**
- **Public Awareness and Understanding of CCS as viable part of a Climate Solution**



# Europe

- **EU-Level**
  - **ZEP (Zero Emissions Fossil Fuel): Flagship Program**
    - Website: [www.zero-emissionplatform.eu](http://www.zero-emissionplatform.eu)
    - Strategic Agendas for Research and Deployment
  - **EC Communications on CCS (TREN,ENV,RES)**
  - **DG ENV EU ETS initiatives to:**
    - Accommodate CCS in Phase II
    - Fully recognise in Phase III
- **Member-State Level**
  - **UK**
    - Cross-departmental regulatory task force
    - UK- Norwegian North Sea Task Force
    - DTI led competition to select a CCS project for support
  - **Germany**



# European Technology Platform ZEP



## European Technology Platform

**The Vision**

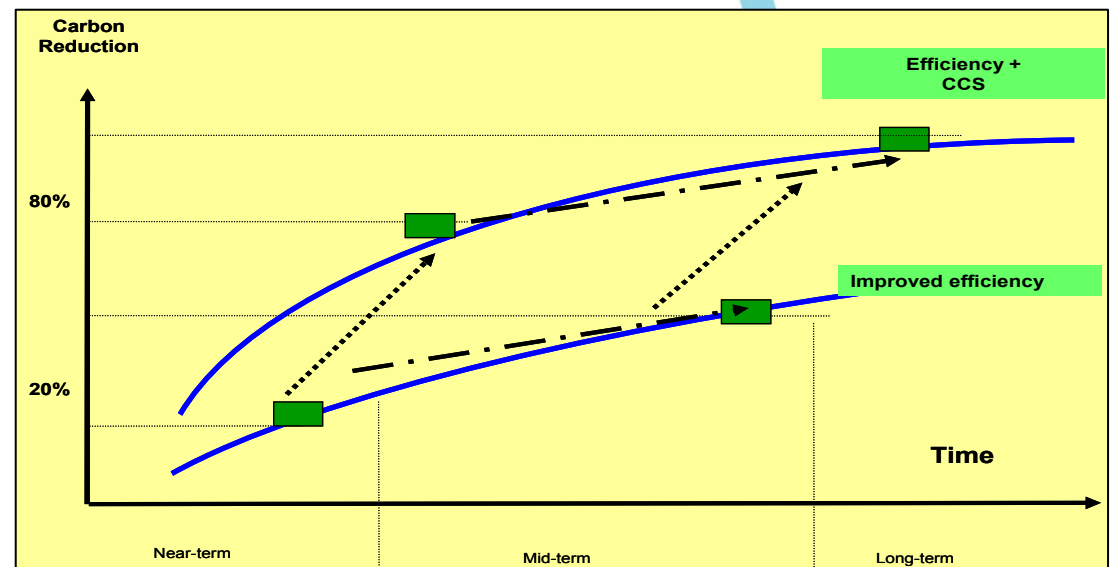
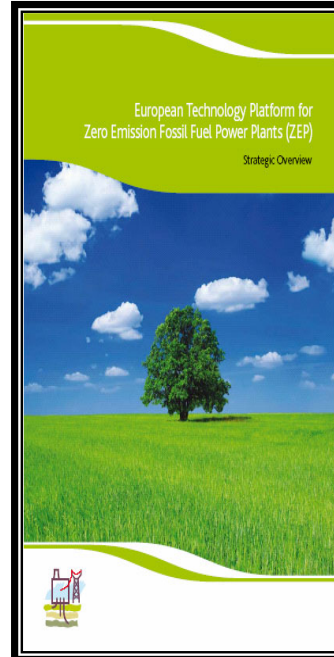
*To enable European fossil fuel power plants to have zero emission of CO<sub>2</sub> by 2020*

**The Project**

Climate change is one of the most serious single challenges faced by humankind today. Probably one of the greatest impacts in reducing CO<sub>2</sub> emissions will be made by the introduction of zero emission fossil fuel power plant including carbon dioxide capture and storage.

The formation of the European Technology Platform on Zero Emission Fossil Fuel Power Plant (ZEP) confirms the EU's continued commitment to its leadership role in reducing CO<sub>2</sub> emissions and the immense challenge of keeping the average global temperature increase below 2°C relative to pre-industrial level.

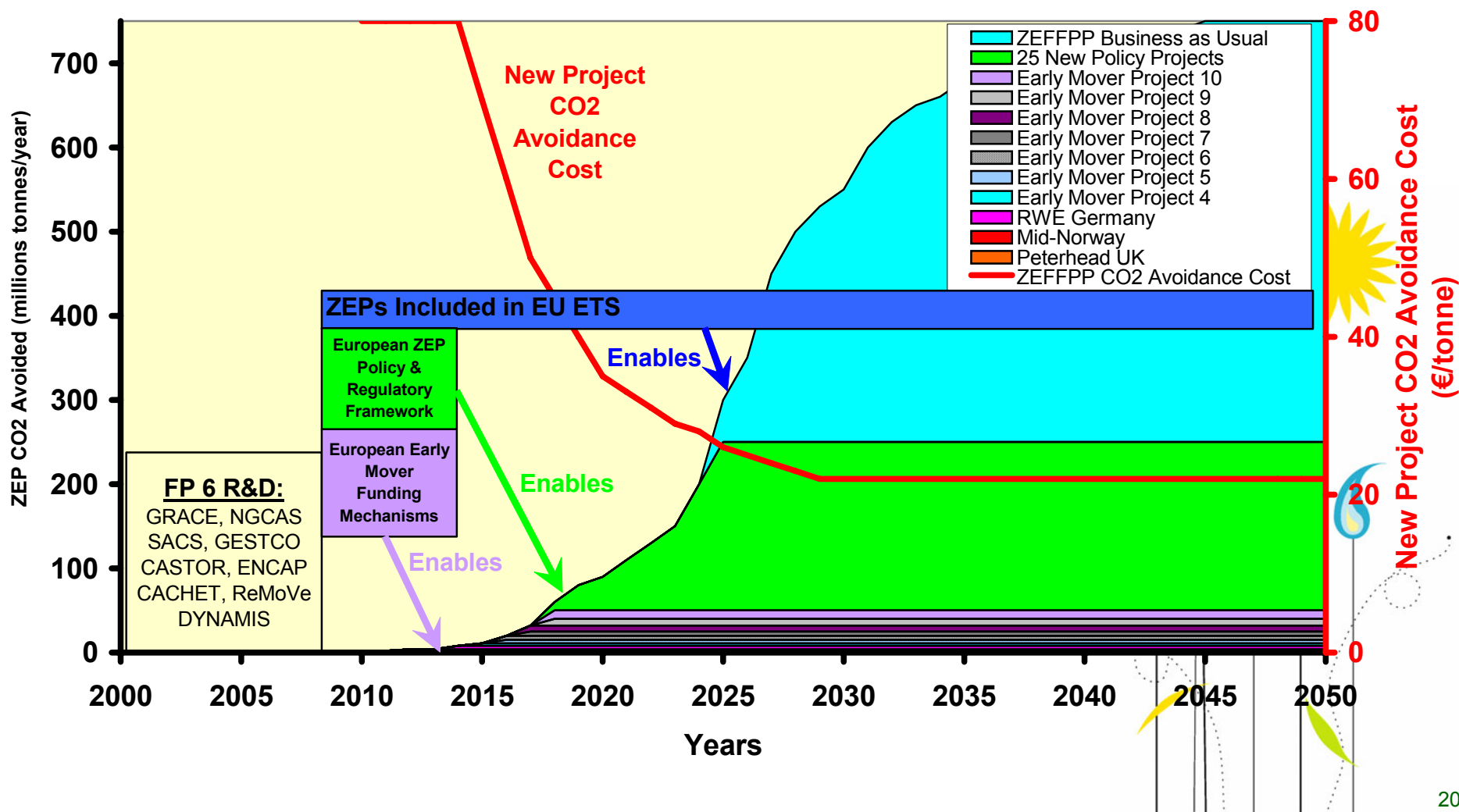
The ZEPFPP Technology Platform will play a crucial role in enabling the EU to fulfil this commitment and has the goal that new competitive options will be developed and deployed for zero emission fossil fuel power plants within the next 15 years and hence help European industry to compete effectively on world markets.





# CCS Deployment Roadmap for Europe

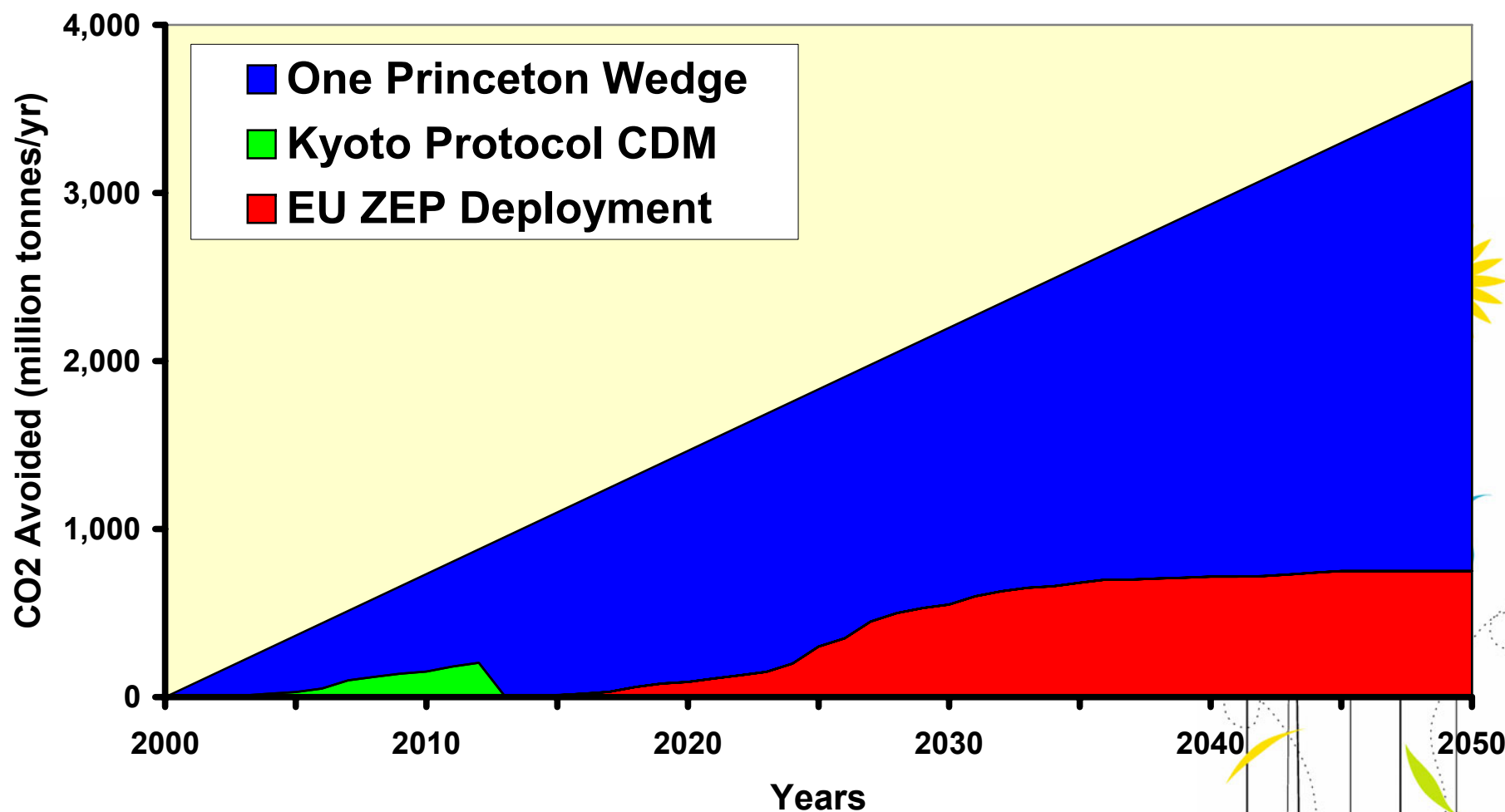
## EU ZEP Deployment Roadmap



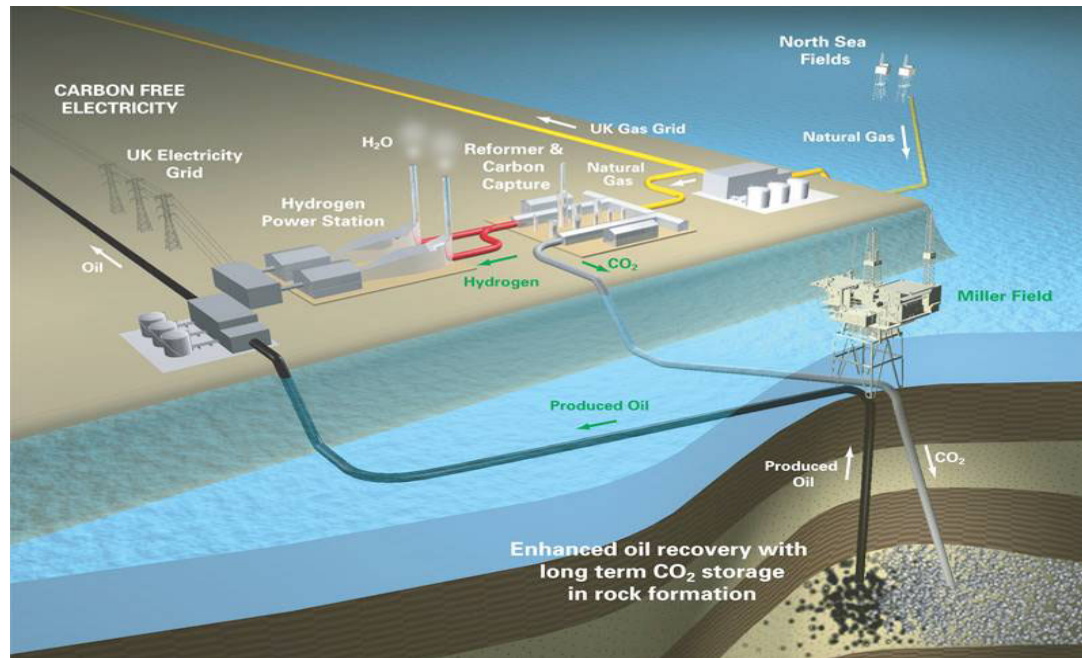


## EU CCS Deployment, CDM and One Wedge

### CO2 Mitigation vs One Princeton Wedge



# Peterhead Hydrogen Power Project, Scotland



## Project Milestones

- Europe's largest hydrogen-fired power generation facility
- First CO<sub>2</sub> EOR project in North Sea
- 1<sup>st</sup> CO<sub>2</sub> storage in an offshore oil field
- Uses Auto Thermal Reforming technology

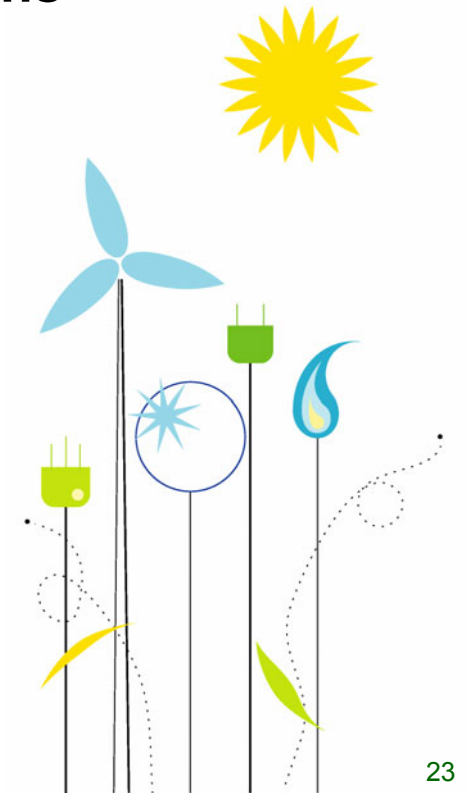
## Project Fun Facts

- 475 MW of clean electricity - enough to power about 300,000 homes
- 1.8 mmtpa CO<sub>2</sub> captured and stored = 500,000 cars off the road
- Almost equivalent to the UK's installed wind farm capacity

# Australia



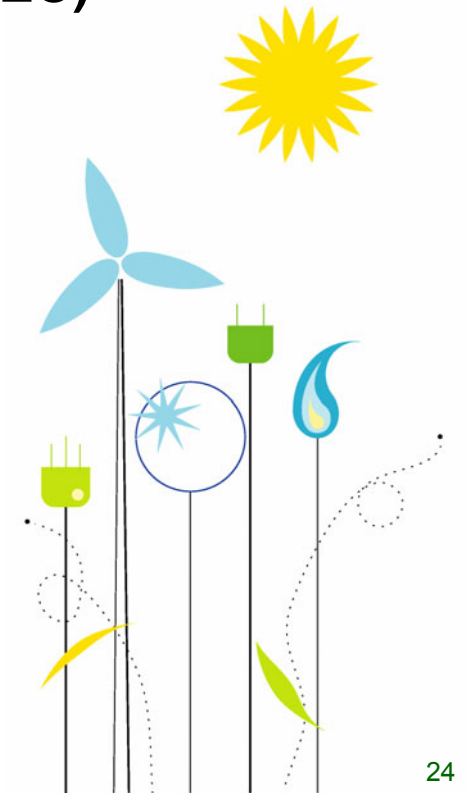
- **Joined-up thinking on both Policy and Regulatory Frameworks**
- **Major Government-backed Project funding Program**
  - **Managed by CSIRO**
- **Draft legislation to enable CCS in saline formations**



# China



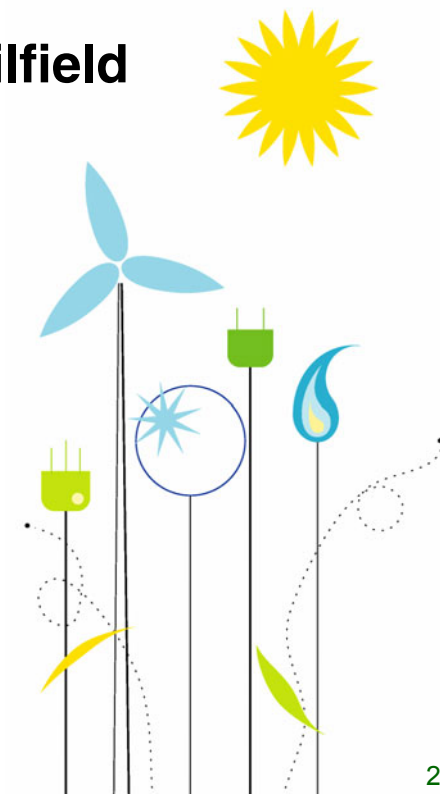
- Domestic Programs for IGCC and CTL
- US: Participation in FutureGen
- EU: Cooperating Action on CCS in China (COACH)
- UK: Near-Zero Emissions Coal Co-Operation (NZECC)
- AP6: IGCC / Co-Production Initiative
- Otherwise waiting for Annex 1 countries to lead





## Middle East

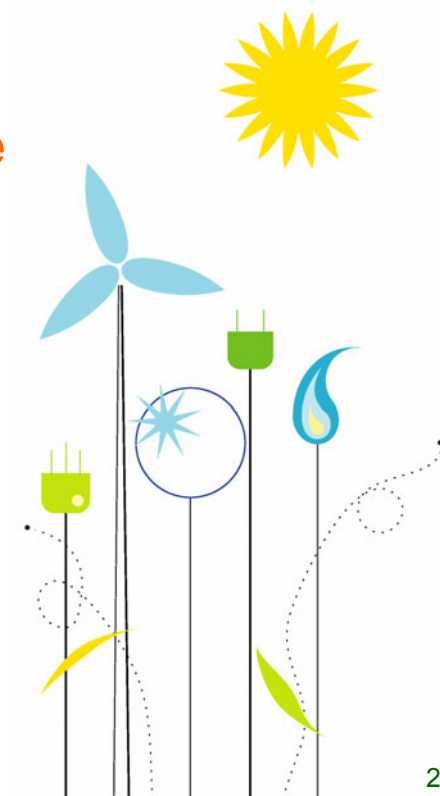
- **Rapid Industrial Development**
- **Growth in power demand (gas-fired) and desalination**
- **Desire to diversify oil-dependant economies**
- **Huge CO<sub>2</sub> EOR opportunity**
- **Opportunity to use CO<sub>2</sub> to replace methane for oilfield pressure support**
- **OPEC Promoting CCS in CDM**





# Summary

- BP is Taking **Big** Steps Towards CCS Deployment
- What's required:
  1. Growing Power Market
  2. Advantaged fuel, infrastructure, geology
  3. Supporting Government Policy
  4. Regulatory Framework for CO<sub>2</sub> geological storage
- BP is ready to invest in CCS projects where we think the four requirements can be met



# Thank You: Questions?

